

NOTES ON NUMERICAL FLUID MECHANICS

Volume 6

Norbert Peters
Jürgen Warnatz

Numerical Methods
in
Laminar Flame Propagation

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Numerical Methods In Laminar Flame Propagation

Norbert Peters, Jürgen Warnatz



Numerical Methods In Laminar Flame Propagation:

Numerical Methods in Laminar Flame Propagation Norbert Peters, Jürgen Warnatz, 2013-11-21 *Reacting Flows*
G. S. S. Ludford, American Mathematical Society, 1986-12-31 These two volumes represent the culmination of the Special Year 84 85 in Reacting Flows held at Cornell University As the proceedings of the 1985 AMS SIAM Summer Seminar in Applied Mathematics the volumes focus on both mathematical and computational questions in combustion and chemical reactors They are addressed to researchers and graduate students in the theory of reacting flows Together they provide a sound basis and many incentives for future research especially in computational aspects of reacting flows Although the theory of reacting flows has developed rapidly researchers in the two subareas of combustion and chemical reactors have not communicated The main goal of this seminar was to synthesize the mathematical theory and bring it to the interface with large scale computing All of the papers have high research value but the first five introductory lectures should be especially noted

Numerical Methods in Laminar Flame Propagation Norbert Peters, Jürgen Warnatz, 1982 This volume collects the results of a workshop held at Aachen West Germany Oct 12 Oct 14 1981 The purpose in bringing together scientists actively working in the field of numerical methods in flame propagation was two fold 1 To confront them with recent results obtained by large activation energy asymptotics and to check these numerically 2 To compare different numerical codes and different transport models for flat flame calculations with complex chemistry Two test problems were formulated by the editors to meet these objectives Test problem A was an unsteady propagating flat flame with one step chemistry and Lewis number different from unity while test problem B was the steady stoichiometric hydrogen air flame with prescribed complex chemistry The participants were asked to solve one or both test problems and to present recent work of their own choice at the meeting The results of the numerical calculations of test problem A are challenging just as much for scientists employing numerical methods as for those devoted to large activation energy asymptotics Satisfactory agreement between the five different groups were obtained only for two out of six cases those with Lewis number Le equal to one The very strong oscillations that occur at $Le = 2$ and a nondimensional activation energy of 20 were accurately resolved only by one group This case is particularly interesting because the asymptotic theory so far predicts instability but not oscillations

Mathematical Modeling in Combustion and Related Topics Claude-Michel Brauner, Claudine Schmidt-Lainé, 2012-12-06 This volume contains invited lectures and contributed papers presented at the NATO Advanced Research Workshop on Mathematical Modeling in Combustion and related topics held in Lyon France April 27 30 1987 This conference was planned to fit in with the two month visit of Professor G S S Ludford to the Ecole Centrale de Lyon He kindly agreed to chair the Scientific and Organizing Committee and actively helped to initiate the meeting His death in December 1986 is an enormous loss to the scientific community in general and in particular to the people involved in the present enterprise The subject of mathematical modeling in combustion is too large for a single conference and the selection of topics reflects both areas of recent research

activity and areas of interest to Professor G S S Ludford to whose memory the Advanced Workshop and this present volume are dedicated. The meeting was divided into seven specialized sessions: detonation theory, mathematical analysis, numerical treatment of combustion problems, flame theory, experimental and industrial aspects, complex chemistry, and turbulent combustion. It brought together researchers and engineers from University and Industry. See below the closing remarks of the workshop by Prof N Peters. The articles in this volume have been judged and accepted on their scientific quality and language; corrections may have been sacrificed in order to allow quick dissemination of knowledge to prevail. **Nonlinear**

Hyperbolic Equations – Theory, Computation Methods, and Applications Josef Ballmann, Rolf Jeltsch, 2013-03-08. On the occasion of the International Conference on Nonlinear Hyperbolic Problems held in St Etienne France 1986, it was decided to start a two years cycle of conferences on this very rapidly expanding branch of mathematics and its applications in Continuum Mechanics and Aerodynamics. The second conference took place in Aachen FRG March 14-18 1988. The number of more than 200 participants from more than 20 countries all over the world and about 100 invited and contributed papers well balanced between theory, numerical analysis, and applications do not leave any doubt that it was the right decision to start this cycle of conferences of which the third will be organized in Sweden in 1990. This volume contains sixty eight original papers presented at the conference, twenty two of them dealing with the mathematical theory, e.g. existence, uniqueness, stability, behaviour of solutions, physical modelling by evolution equations. Twenty two articles in numerical analysis are concerned with stability and convergence to the physically relevant solutions, such as schemes especially devised for treating shocks, contact discontinuities, and artificial boundaries. Twenty four papers contain multidimensional computational applications to nonlinear waves in solids, flow through porous media, and compressible fluid flow, including shocks, real gas effects, multiphase phenomena, chemical reactions, etc. The editors and organizers of the Second International Conference on Hyperbolic Problems would like to thank the Scientific Committee for the generous support of recommending invited lectures and selecting the contributed papers of the conference. **Recent Advances in Combustion Modelling**

Bernard Larrouturou, 1991. This volume gathers the contributions of six world experts to a course on combustion modelling. Therefore a pedagogical effort has been made in writing up these texts which cover state of the art advances in most aspects of combustion science. The book is aimed at students, researchers, and engineers as was the course. *Adaptive Multilevel Solution of Nonlinear Parabolic PDE Systems* Jens Lang, 2013-06-29. Nowadays there is an increasing emphasis on all aspects of adaptively generating a grid that evolves with the solution of a PDE. Another challenge is to develop efficient higher order one step integration methods which can handle very stiff equations and which allow us to accommodate a spatial grid in each time step without any specific difficulties. In this monograph a combination of both error controlled grid refinement and one step methods of Rosenbrock type is presented. It is my intention to impart the beauty and complexity found in the theoretical investigation of the adaptive algorithm proposed here in its realization and in solving non trivial complex problems. I hope

that this method will find many more interesting applications Berlin Dahlem May 2000 Jens Lang Acknowledgements I have looked forward to writing this section since it is a pleasure for me to thank all friends who made this work possible and provided valuable input I would like to express my gratitude to Peter Deuflhard for giving me the opportunity to work in the field of Scientific Computing I have benefited immensely from his help to get the right perspectives and from his continuous encouragement and support over several years He certainly will forgive me the use of Rosenbrock methods rather than extrapolation methods to integrate in time

Advanced Combustion Science Tsuneo Someya, 2012-12-06 Non uniform combustion as encountered in diesel and gas turbine engines furnaces and boilers is responsible for the conversion of fossil fuel to energy and also for the corresponding formation of pollutants In spite of great research efforts in the past the mechanism of non uniform combustion has remained less explored than that of other combustion types since it consists of many mostly transient processes which influence each other In view of this background a group research project Exploration of Combustion Mechanism was established to explore the mechanism of combustion especially that of diffusive combustion and also to find efficient ways to control the combustion process for better utilization of fuel and the reduction of pollutant emission The group research was started after preparatory activity of 2 years in April 1988 for a period of 3 years as a project with a Grant in Aid for Scientific Research of Priority Area subsidized by the Ministry of Education Science and Culture of Japan The entire group of 43 members was set up as an organizing committee of 13 members and five research groups consisting of 36 members The research groups were 1 Steady combustion 2 Unsteady spray combustion 3 Control of combustion 4 Chemistry of combustion and 5 Effects of fuels At the beginning of the project it was agreed that we should pursue the mechanism of combustion from a scientific viewpoint namely the target of the project was to obtain the fundamentals or know why rather than know how of combustion

Combustion J. Warnatz, Ulrich Maas, Robert W. Dibble, 2013-04-17 Combustion is an old technology which at present provides about 90% of our worldwide energy support Combustion research in the past used fluid mechanics with global heat release by chemical reactions described with thermodynamics assuming infinitely fast reactions This approach was useful for stationary combustion processes but it is not sufficient for transient processes like ignition and quenching or for pollutant formation Yet pollutant formation during combustion of fossil fuels is a central topic and will continue to be so in the future This book provides a detailed and rigorous treatment of the coupling of chemical reactions and fluid flow Also combustion specific topics of chemistry and fluid mechanics are considered and tools described for the simulation of combustion processes For the 3rd edition the text has been thoroughly revised and updated

Modern Developments in Energy, Combustion and Spectroscopy F.A. Williams, A.K. Oppenheim, D.B. Olfe, M. Lapp, 2013-10-22 This compendium of technical articles is dedicated to Professor Stanford Solomon Penner on the occasion of his 70th birthday As one of the most prominent scientists of our times he has been particularly instrumental in advancing the field of combustion science while simultaneously he has developed quantitative spectroscopy

into an important engineering discipline and is also a leading international expert on energy issues. Written primarily by researchers who were Professor Penner's doctorate students during the last four decades, the articles consist of original contributions as well as previously published papers that provide important insights into combustion spectroscopy and energy problems. Among the topics included are turbulent combustion, flame structure, detonations, spectroscopic diagnostics, spectroscopy of atmospheric gases, and physical problems associated with nuclear reactors as well as electric power distribution and energy conversion. The book includes a short biography of Professor Penner and a complete bibliography of his publications.

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